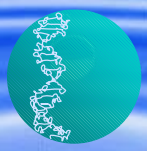
UMBI Bioscience at the Forefront to Meet Societal Needs

# University of Maryland Biotechnology Institute

## 2015 Strategic Plan



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# Shared Commitment to UMBI's Envisioned Future

This document represents the University of Maryland Biotechnology Institute's (UMBI) plan/roadmap for achieving our envisioned future in the year 2015 and beyond. The plan is intended to engage the UMBI community and to provide a context for strategic decision-making to better serve the State's citizenry, the University System of Maryland, and Maryland's biotechnology industry. The plan has been developed collaboratively by the leadership of UMBI's research and administrative units in consultation with our faculty, staff, students and Board of Visitors.

We the undersigned leaders of UMBI ratify this plan. We encourage the entire UMBI community to read it, make it your own and join us in implementing the changes needed to move toward our envisioned future. Everyone has a role to play in our continued success.

Jennie C. Hunter-Cevera
President

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Center for Advanced Research in Biotechnology

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Center of Marine Biotechnology

John Collins, Chair
UMBI Senate

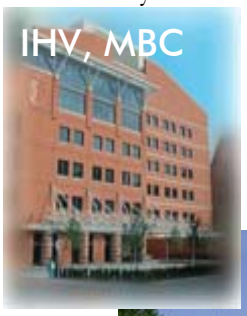
February 2005

## Executive Summary

There comes a time in the evolution of any organization when the original vision, mission and objectives need to be re-examined. That time has come for the University of Maryland Biotechnology Institute (UMBI). UMBI was founded in 1985 by the Board of Regents of the University of Maryland based on recommendations by the 1982 Governor's Ad Hoc Committee on High Technology in Maryland. Since then, UMBI has grown from two Centers to five diverse biotechnology Centers, and from a $2.6 million operating budget to a working budget of more than $53 million in FY05. The concept has become a reality.

**"a premier research institution for basic and translational research in biotechnology"**

Our five biotechnology-research Centers are strategically located within Maryland's principal biotechnology and biomedical research clusters. Three Centers, the Center of Marine Biotechnology (COMB), the Medical Biotechnology Center (MBC) and the Institute of Human Virology (IHV) are located in Baltimore. The Center for Biosystems Research (CBR) is located in College Park, and the Center for Advanced Research in Biotechnology (CARB) is located in Rockville. These five Centers constitute one exceptional research-intensive institution with many talents. Focused Programs of Excellence within and across the Centers have influenced and moved biotechnology forward in Maryland through leading and partnering with state, federal and private entities.







As we look to 2015, we greet the challenges of our new goals with a renewed commitment to, and excitement about, becoming a premier research institution for basic and translational research in biotechnology that resolves forefront scientific problems important to society. This is our vision.

UMBI will stay true to its core values as it moves forward to fulfill its mission to conduct groundbreaking research in key areas of biotechnology, to make fundamental discoveries, to generate innovative solutions to practical problems, and to develop new technologies for commercial application. In addition, knowing that our people are our greatest asset, we commit to providing an exceptional environment for specialized training and to mentoring tomorrow's biotechnology workforce while catalyzing economic growth.

UMBI has established five strategic goals for the next ten years. Each member of the UMBI community has a role in accomplishing some of the objectives in this Plan using strategies and tactics developed cooperatively by UMBI faculty, staff, and management. Collective progress toward these goals over time will be measured using key metrics (Appendix I). UMBI's strategic goals are as follows:

- Integrate and build scientific expertise at UMBI to focus interdisciplinary research programs on problems important to society

- Enhance the impact and value of UMBI's cutting edge science and technology to ensure the vitality of Maryland's biotechnology enterprises

- Further capitalize on UMBI's dynamic research environment to train scientists, educate the workforce in critical technologies, and to inform the public on important issues involving biotechnology

- Maximize the economic impact of UMBI's programs

- Improve recognition of UMBI's accomplishments to advance UMBI's research programs

I would like to thank the UMBI community for contributions to the development of this Strategic Plan. The discussions were of great value in recognizing our strengths and focusing on areas where improvements are needed. In particular, I acknowledge the members of the workgroups (listed in Appendix II) for their dedication in assisting with the writing and editing process. I look forward to working with each of you as we implement the strategies associated with each goal of this strategic plan that will advance UMBI science to the forefront to meet societal needs.

Jennie C. Hunter-Cevera, Ph.D.
President
February 2005

# The University of Maryland Biotechnology Institute 2015 Strategic Plan

## *Introduction*

UMBI is the biotechnology institute of the University System of Maryland. Biotechnology has enormous potential to improve the quality of life in areas ranging from more effective medicines, increased nutritional quality of foods, maintaining a clean and healthy environment, providing alternative sources for energy, and new and improved biomaterials. However, biological systems are complex, and biotechnology is a fast-paced competitive field requiring an organization that can adapt to changing needs. UMBI's unique organizational structure enables it to address emerging problems by rapidly integrating its unique capabilities and multidisciplinary approaches to develop practical solutions, and by translating basic discoveries into commercial benefit. UMBI has played a key role in advancing biotechnology in Maryland and indeed, throughout the world. Its internationally recognized Programs of Excellence in human virology and AIDS, marine biotechnology, medical biotechnology, structural biology, and systems biology have provided important scientific breakthroughs, new technologies, and innovative training that have delivered significant economic benefits to the citizens of Maryland.

## *Vision*

UMBI's vision is to be a premier research institution for basic and translational research in biotechnology that resolves forefront scientific problems important to society.

## *Mission*

UMBI's mission is to conduct groundbreaking research in key areas of biotechnology, to make fundamental discoveries, generate innovative solutions to practical problems, and develop new technologies for commercial application. UMBI is committed to providing an exceptional environment for specialized training and to mentoring tomorrow's biotechnology workforce while promoting economic growth.

### Core Values

In achieving this strategic plan, UMBI will be guided by these core values that underpin everything we do:

**Excellence.** We strive for excellence in all endeavors comprising the conduct and administration of UMBI's research programs.

**Integrity.** We demand the highest standards of ethical and professional conduct from all members of the UMBI community.

**People.** Our people are our most valuable asset. The UMBI community is composed of scientists, students, staff and administrators who are talented, passionate, trusted, loyal and committed to the continued success of our organization. Building on the diversity of people and their scientific talents is key to achieving UMBI's vision.

**Mentoring.** Nurturing the next generation of scientific leaders and workforce training in critical biotechnologies are integral components of our scientific Programs of Excellence.

**Service and Accountability.** UMBI takes seriously the obligation to be a responsible steward of the resources invested by the State. We leverage these resources to build our Programs of Excellence.

**Integration and Multidisciplinarity.** Integration of capabilities and approaches across multiple disciplines and Centers are key to continuing advancement of biotechnology and future innovation at UMBI.

**Shared Governance.** UMBI is a community of scientists, staff and administrators each of whom provides a perspective to be considered during the process of setting future directions and making decisions.

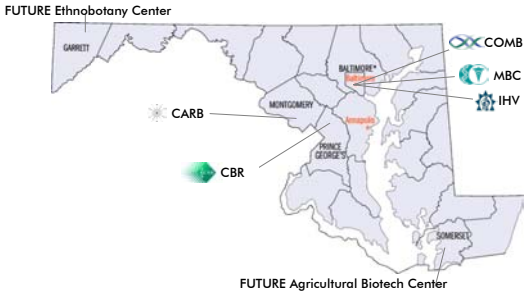
## *Who We Are*

UMBI is the youngest of the 13 individual institutions within the University System of Maryland. In October 1982, the Governor's Ad Hoc Committee on High Technology in Maryland concluded that timely and consistent investment to stimulate the State's high technology industry represented a realistic opportunity for more jobs, a broadened tax base, and the maintenance of a desirable quality of life for Maryland citizens. On November 18, 1983, the University of Maryland Task Force on High Technology/Biotechnology submitted its Report to the Educational Policy Committee of the Board of Regents of the University of Maryland. The Task Force recommended in its Report that a center of excellence in biotechnology - the Maryland Biotechnology Institute - be established as a separate unit of the University of Maryland.

> ...the Maryland Biotechnology Institute will provide administrative coordination within the University, will serve to catalyze the development of biotechnology initiatives in response to state, federal and public needs, and will work with industries to apply broad biotechnology expertise to pressing issues of concern to the region and nation.

In January 1984, the Board of Regents of the University of Maryland unanimously approved a "Resolution Regarding the Establishment of a Maryland Institute of Biotechnology." In 1985, the governor's FY86 budget included $2.575M to establish two Centers proposed by the University of Maryland as components of its Maryland Biotechnology Institute - CARB and COMB. The General Assembly approved these expenditures and the University of Maryland Biotechnology Institute was effectively created.

Today, UMBI is a $53M research enterprise (FY05 working budget) organized into a network of five research Centers (CARB, COMB, CBR, MBC and IHV) strategically located within Maryland's principal biotechnology and




biomedical research clusters. UMBI's research Centers focus on advancing biotechnology through leading and partnering with federal and academic institutions, biotechnology companies and stakeholders.

UMBI is a research institute with many talents and resources that takes on difficult and challenging research problems, addresses specific needs and gaps within biotechnology, and prides itself on being able to find solutions through both basic and applied research. As an intensive research hub within Maryland, UMBI covers the breadth and depth of biotechnology while mentoring the future generation of biotechnologists. UMBI scientists pursue fundamental and applied biotechnology studies that lead to novel discoveries and important cutting edge advances in the biosciences that improve people's health, their environment and the food they eat. UMBI translates bioscience at the forefront to meet societal needs.

## *Organizational Structure*

UMBI is comprised of Central Administration and five research Centers.

## Central Administration

UMBI's Central Administration serves as the umbrella or architecture that links the five Centers within a seamless matrix management structure. It will continue to support and enhance the diverse activities and programs within the Centers, to protect intellectual assets, and to work with the Centers to develop technologies for commercialization. Central Administration will continue to enhance its programs and activities to meet the needs of its Centers as it implements the tactics to achieve the goals set forth in the 2015 Strategic Plan. Within Central Administration are the following units:

### Office of the President

The President leads UMBI and is responsible for its vision, mission and the activities involved in completing and implementing the strategic plan. The President is the principal spokesperson for UMBI. All operational units plus the five Centers report to the President.

### Office of Academic Affairs

This office focuses on matters relating to UMBI faculty and educational programs. Responsibilities include faculty appointments and review processes, developing programs to nurture and support faculty endeavors, managing conflicts of interest and reviews of research activities in partnership with the Centers. This office develops and coordinates UMBI's K-12 education and outreach programs for students, professional development for teachers, and the education of stakeholders.

### Office of Research and Development

This office works with the Centers in the pre-award, post-award and closeout of sponsored research contracts and grants. The office is responsible for laboratory safety, biosecurity, regulatory compliance, and for protecting and commercializing intellectual property developed through UMBI research. This includes evaluation of invention disclosures, prosecution of patent applications, negotiating licenses and directing commercialization activities.

### Office of Operations and Finance

This office handles UMBI's financial and infrastructure functions and matters. It is responsible for maintaining the financial health of the organization, the development of human resources, information technology and security. In addition, it is responsible for facility management of building assets within UMBI.

### Office of Institutional Advancement

This office focuses on the activities that support advancement of UMBI as an institution. Key responsibilities include external public relations, representing UMBI's interests with local, state and federal legislators, fundraising and publications.

## Center of Marine Biotechnology

Integrating research excellence with education, training and economic development, the Center of Marine Biotechnology (COMB) mission is to apply the tools of modern biology and biotechnology to study, protect, and enhance marine and estuarine resources. COMB has earned international acclaim in

its two Programs of Excellence on aquaculture and fisheries biotechnology and marine microbial biotechnology, and its three integrative programs in environmental biotechnology, natural products and emerging technologies. Addressing both the Chesapeake Bay and the world's oceans, critical studies are conducted on fundamental topics including: molecular basis of shellfish and finfish life cycles, enhancing health, breeding, hatchery and stock replenishment (blue crab and finfish), innovative technologies for the sustainable production of seafood, harmful algae and pollutants, bioremediation, microbial life in extreme environments, ocean-borne diseases and production of pharmaceuticals and other bioproducts by marine organisms. COMB scientists maintain strong partnerships with the State of Maryland (e.g., DNR, MDA, DBED), industry (e.g., Maryland watermen, aquaculture, seafood and pharmaceutical) and sister UMBI Centers in developing environmentally compatible mariculture, improving the health and wealth of the oceans and the Chesapeake Bay, and discovering marine-derived commercially important processes and compounds.

COMB's modern 165,000 square foot facility, located in the Columbus Center at Baltimore's Inner Harbor, comprises many unique core capabilities and facilities. These include Maryland's only extremophile scale-up fermentation facility, as well as Biosafety Level 3 laboratories for studying marine toxins, marine transgenic core laboratory, a state-of-the-art, completely contained and biosecure aquaculture research center, algae culture laboratories, and a zebrafish facility. Coupled with DNA sequencing, imaging, gene quantification, post-genomics and bioinformatics capabilities, COMB's scientific infrastructure lays the foundation for its unique integration of modern biology and biotechnology with the traditional marine sciences.

## Institute of Human Virology

The Institute of Human Virology (IHV) is a Center of UMBI, and also affiliated with the School of Medicine at the University of Maryland, Baltimore and the University of Maryland Medical System. IHV was established to create and develop a world-class Program of Excellence focusing on chronic viral diseases and virally linked cancers. A particular focus is on learning how to utilize the body's natural chemistry for its own therapeutic potential and pursuing biologically-based treatment approaches that are less toxic to the body and, often, less costly to the patient and to the public. The Institute of Human Virology applies the disciplines of basic research, epidemiology and clinical research in a concerted effort to speed the discovery of diagnostics, preventative vaccines and therapeutics for a wide variety of chronic and deadly viral and immune disorders - most notably HIV, the virus that causes AIDS. In concert with the clinical research programs, IHV provides clinical services to HIV/AIDS patients both locally in the Baltimore region and globally through our programs in Africa and the Caribbean.

IHV is organized in five divisions (Basic Research, Vaccine Development, Animal Models, Clinical Research and Epidemiology & Prevention) that facilitate translation of scientific research findings from the laboratory to the treatment of patients. These capabilities have allowed IHV to foster successful strategic alliances with global partners such as Catholic Relief Services - a non-governmental organization with whom IHV envisions a long-term collaboration for international AIDS relief work.

## Medical Biotechnology Center

The Medical Biotechnology Center (MBC) seeks to resolve significant problems in biology and medicine through basic and applied biotechnology. It is dedicated to creating and applying state-of-the-art biochemical, molecular and cellular technologies to study human disease mechanisms. Through investigations of molecular biophysics and cellular signal transduction, MBC scientists seek to unravel vexing medical problems that include Alzheimer's and prion diseases, cardiac arrhythmias and failure, dysfunctions in molecular signaling and protein processing, as well as cellular development abnormalities. In addition, the MBC develops new technologies for exploring human biology, with an emphasis on nanobiology tools and imaging techniques.

MBC is a world leader in dynamic Ca2+ detection and imaging through optical (e.g. fluorescence) and non-optical modalities. MBC resources available to local, national and international scientists and entrepreneurs include confocal fluorescence microscopy, multiphoton imaging and photolysis, FRET imaging of cellular protein architecture and function, as well as associated tools for image data processing and visualization. MBC researchers offer a diversity of flexible and adaptable enabling technologies, including radiative decay engineering, design and synthesis of light-activated molecular probes, and molecular tools for electron paramagnetic resonance imaging and spectroscopy. Research enhancements at MBC include the shared animal and transgenic facility, the zebrafish resource, the adenovirus and lentivirus resource, the animal telemetry core, the *C. elegans* resource and a Biosafety Level 3 laboratory suite. MBC faculty collaborate widely with other UMBI Centers, with other research universities within the University System of Maryland, with Maryland-based businesses, with the National Institutes of Health and national biodefense groups, and with many international partners.

## Center for Biosystems Research

The Center for Biosystems Research (CBR) promotes research and training in the application of multiple experimental approaches to study complex biological systems. These efforts expose CBR scientists and students to a variety of experimental systems and techniques and lead to novel ways of viewing problems of mutual interest. This in turn allows the Center to address a wide range of important biological questions and to respond quickly to new technological developments in the rapidly advancing and dynamic field of biotechnology. Areas of research at CBR emphasize pathobiology (plants and animals), biomolecular/metabolic engineering and genome sciences. Commercial development is facilitated by integration of advances in biotechnology with innovation in bioprocess engineering. Practical advances include the development of novel poultry and fish vaccines, the use of insects as bioreactors for production of industrial and therapeutic proteins, and the recycling of crab shell wastes to produce industrial polymers.

CBR is located in the Plant Sciences Building on the College Park campus of the University of Maryland. This location facilitates collaborations with the University of Maryland Engineering Research Center and the nearby USDA Beltsville Agricultural Research Center. CBR supports the University of Maryland Bioprocess Scale-up Facility in partnership

with the Clark School of Engineering and provides DNA sequencing and microarray services for the members of the regional bioscience community. In collaboration with CARB, CBR is developing state-of-the-art insect and plant transformation core facilities as part of UMBI's Shady Grove expansion.

## Center for Advanced Research in Biotechnology

The Center for Advanced Research in Biotechnology (CARB) is a cooperative venture of UMBI, the National Institute of Standards and Technology (NIST) and Montgomery County, MD. CARB's primary mission is to promote advanced research and interdisciplinary training in fundamental problems at the forefront of biotechnology through the collaboration of scientists from NIST, UMBI and industry. The internationally recognized research programs at CARB are focused on the structure, function, design and evolution of biological macromolecules, and rely on a variety of multidisciplinary approaches ranging from x-ray crystallography, multidimensional nuclear magnetic resonance (NMR) spectroscopy, molecular, cell and physical biochemistry, and computational biology and modeling. Building on the Programs of Excellence that elucidate structure-function relationships at the molecular level, CARB is developing a new program to enable a more quantitative, integrated understanding of complex biological phenomena at the cell and organismal level.

The research facilities at CARB will undergo a substantial expansion in 2005 with the construction of CARB II. This will add 139,000 gross square feet of space for research, education and administration, and will double the existing lab space on the University of Maryland Shady Grove campus. The additions will provide critically needed state-of-the-art facilities and core laboratories for structural biology, proteomics, plant and insect transformation and GMP bioprocessing.

The timing of the facilities expansion dovetails nicely with the maturation of developing research programs at CARB, and in cooperation with NIST and UMBI's Center for Biosystems Research, scientists at the Center will develop and apply critical new technologies in the field of molecular systems biology.

## *Strategic Goals*

Biotechnology will face many challenges over the next decade. These include the fast pace of technological change, the evolution of new national priorities and societal needs, shifts in funding and capital sources, and regional competition for biotechnology preeminence through new investments in research, infrastructure, and company development. In its role as Maryland's Biotechnology Institute, UMBI has developed unique research expertise, infrastructure, and partnerships that have contributed to Maryland's competitive advantage in biotechnology and that will serve it well in responding to these future challenges.

UMBI benefits from the strength of excellent investigator-initiated research and an organizational structure that allows rapid integration of existing research expertise to focus multidisciplinary approaches on emerging opportunities and needs. UMBI has core technologies and specialized research infrastructure that provide opportunities for advanced training, workforce development, and service to the private sector that are unparalleled. This complement of resources also positions UMBI to promote translational research through productive collaborations with academic, governmental, and industrial partners. The strategic framework presented below capitalizes on UMBI's rich research expertise, unique organization, and advanced technical capabilities to sustain and extend Maryland's leadership position in biotechnology research and training.

**"UMBI has developed unique research expertise, infrastructure, and partnerships that have contributed to Maryland's competitive advantage in biotechnology"**

## Goal 1: Integrate and build scientific expertise at UMBI to foster interdisciplinary research programs that focus on problems important to society

New breakthroughs to pressing problems in biotechnology will require the adaptation of cutting edge technologies to complex biological systems. The individual investigator-driven research programs at UMBI are strong, broadly recognized, and diverse, ranging from the study of organisms that thrive in extreme environments, to those that live in the Chesapeake Bay, and those that cause plant, animal and human diseases. UMBI will further capitalize on our foundation of individual investigator programs by integrating in ways that allow us to derive the maximum benefit from faculty research expertise and Programs of Excellence. Integration of forefront disciplines requires not only excellent science, but also the ability to adapt quickly and combine the necessary capabilities together to meet emerging challenges, which is difficult to achieve in a traditional academic setting. The unique environment at UMBI facilitates integration and fosters a collaborative and interdisciplinary approach that expedites solutions to complex scientific problems.

**Strategy 1:** Strengthen existing successful interdisciplinary research programs and foster new programs that complement and build upon existing scientific strengths.

*Tactic 1:* Utilize program grants, training grants, seed funding and reinvestment of indirect revenue funds to build critical mass for interdisciplinary research programs.

*Tactic 2:* Stimulate cross-disciplinary scientific exchange through holding UMBI-wide retreats and workshops in emerging areas of biotechnology to foster development of new inter-Center and inter-institutional research programs.

*Tactic 3:* Increase the impact of the Centers' seminar programs by developing a UMBI-wide seminar announcement system and by incorporating speakers from other UMBI Centers on a regular basis.

*Tactic 4:* Develop a UMBI visiting researcher program including logistical support to facilitate research activity by faculty, staff and students at a location other than their primary Center.

*Tactic 5:* Expand UMBI's core facility concept to support research programs that enable integration of information from molecular, cellular and organismal approaches to better understand applications for biological sciences.

**Strategy 2:** Assemble the expertise to address emerging biotechnology research opportunities and drive future directions in biotechnology.

*Tactic 1:* Establish a UMBI Research Council, with significant faculty participation and advisory to the President, that will facilitate development of research initiatives at UMBI.

*Tactic 2:* Convene inter-Center and inter-institutional groups that explore research frontiers in order to identify new partners from academia, government and industry in emerging areas of biotechnology research.

*Tactic 3:* Expand use of state-of-the-art UMBI core facilities to support large-scale integrative research programs that advance biotechnology and attract strategic partners and funding for translational research.

*Tactic 4:* Develop mechanisms for appointing faculty jointly at two or more UMBI Centers to seize on emerging areas of biotechnology research.

**Strategy 3:** Harmonize mechanisms for ongoing assessment of program performance.

*Tactic 1:* Uphold and enhance UMBI's rigorous performance evaluation processes for faculty and staff using objective-based criteria.

*Tactic 2:* Utilize scientific advisory boards consisting of distinguished scientists and senior UMBI faculty to provide advice for developing, sustaining, and enhancing inter-Center and inter-institutional research programs.

**"The unique environment at UMBI facilitates integration and fosters a collaborative and interdisciplinary approach..."**

## Goal 2: Enhance the impact and value of UMBI's cutting edge science and technology to ensure the vitality of Maryland's biotechnology enterprise

UMBI has contributed substantially to developing a climate for biotechnology innovation in Maryland through its research Programs of Excellence. It is essential to nurture research, develop new technologies, and translate discoveries to applications in order for Maryland to maintain its leadership in promoting biotechnology to fuel economic growth.

**Strategy 1:** Recruit exceptionally talented scientists and staff that cultivate an environment for multidisciplinary basic and applied research.

*Tactic 1:* Use the UMBI Research Council to provide advice and counsel in the development and prioritization of UMBI's major research initiatives and opportunities.

*Tactic 2:* Develop Center program/faculty recruitment plans to address and meet future needs within the Centers and across Programs of Excellence.

*Tactic 3:* Develop an overall UMBI Business Plan that will address resource requirements and future growth.

*Tactic 4:* Establish incentives for inter-Center collaboration.

*Tactic 5:* Streamline the search and selection process to effectively and efficiently recruit and hire talented faculty and staff essential to fulfilling UMBI's mission and goals.

**Strategy 2:** Establish new collaborations to address the most challenging problems in biotechnology.

*Tactic 1:* Develop venues for scientific exchange between academic and research institutions, government and industry in Maryland.

*Tactic 2:* Establish academic and financial mechanisms to facilitate and foster collaborations.

*Tactic 3:* Establish mechanisms to provide "seed" funding to jump start new initiatives addressing the most challenging problems in biotechnology.

*Tactic 4:* Utilize core facilities to attract and support collaborations with Maryland industry, government and other academic institutions.

**Strategy 3:** Work closely with partners to translate breakthroughs in basic science to solve practical problems in biotechnology.

*Tactic 1:* Identify potential practical applications (technologies) arising from basic research at UMBI Centers.

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*Tactic 2:* Assess opportunities in breakthrough scientific areas warranting

further investigation and potential resource investment.

*Tactic 3:* Identify viable partners and match with interested faculty.

*Tactic 4:* Communicate translational opportunities to faculty and industry.

*Tactic 5:* Pursue the establishment of a joint economic development liaison with other state and/or local agencies.

*Tactic 6:* Identify, seek and utilize all funding possibilities for translational research funding.

**Strategy 4:** Develop a scientific review system to maintain the high quality and value of UMBI's research programs.

*Tactic 1:* Assess progress in attaining the goals of the UMBI Strategic Plan annually.

*Tactic 2:* Standardize, update and enforce the UMBI faculty development program and the performance management process for staff to reward, encourage and track progress of all faculty and staff.

*Tactic 3:* Schedule and conduct external reviews of each UMBI unit at least once every three years.

**Strategy 5:** Apply effective and efficient business and academic practices to maintain state-of-the-art facilities for scientific discovery, to invest in new research challenges in a timely manner, and to enhance our Programs of Excellence.

*Tactic 1:* Ensure the Facilities Master Plan and the 10-year Capital Improvement Program are synchronized with research program plans.

*Tactic 2:* Initiate funding a UMBI facility renewal reserve fund.

*Tactic 3:* Increase fundraising efforts through grants and other alternative resources for acquiring state-of-the art equipment.

*Tactic 4:* Develop a resource allocation model to facilitate matching resources to emerging research challenges and priorities.

*Tactic 5:* Update academic and human resource policies and practices to recruit and retain outstanding faculty and staff to support the Programs of Excellence.

*Tactic 6:* Develop internal mechanism(s) to assess effectiveness of organizational structure in providing support for UMBI research programs.

**"It is essential to nurture research, develop new technologies, and translate discoveries to applications in order for Maryland to maintain its leadership in promoting biotechnology to fuel economic growth."**

## Goal 3: Further capitalize on UMBI's dynamic research environment to train scientists, educate the workforce in critical technologies, and to inform the public on important issues involving biotechnology.

Dedicated to innovative basic and translational research in biotechnology, UMBI is ideally poised to provide focused biotechnology training and mentoring experiences for established scientists, graduate and post-graduate trainees, as well as other constituencies requiring these experiences. UMBI recognizes that comprehensive, cutting edge training experiences enhance both the caliber of the research program and the individual trainee's career development. In addition, a well-trained, educated and knowledgeable workforce is of equal benefit to the research endeavor and to Maryland's growing commercial biotechnology community.

**Strategy 1:** Expand UMBI's offering of focused, advanced scientific training in specialized, critical and emerging technologies for practicing scientists.

**"comprehensive, cutting edge training experiences enhance both the caliber of the research program and the individual trainee's career development."**

*Tactic 1:* Organize a structure within UMBI that will assist the Centers in the development and delivery of community-wide symposia, colloquia and workshops for the practicing scientist.

*Tactic 2:* Develop a consolidated UMBI web-based seminar calendar that can be easily accessed by all.

**Strategy 2:** Broaden the scope of training and mentoring provided to undergraduate, graduate and postdoctoral trainees to enhance their preparation for careers in biotechnology.

*Tactic 1:* Develop and deliver a series of programs that addresses needs and opportunities of undergraduate, graduate, and postdoctoral trainees.

*Tactic 2:* Organize a centralized recruitment function for high school and undergraduate students seeking internship placements at UMBI.

*Tactic 3:* Develop databases for faculty to use in maintaining records on their trainees and mentees.

**Strategy 3:** Develop outreach programs to inform the public on important issues involving biotechnology.

*Tactic 1:* Develop colloquia and tutorials for public audiences in order to increase their understanding and knowledge of basic concepts and issues in biotechnology.

*Tactic 2:* Design and implement a biotechnology "expert" database for use in providing information to the public and other concerned parties.

*Tactic 3:* Participate in outreach programs offered by local, state and federal partners, public school systems, and community colleges.

**Strategy 4:** Establish new programs and initiatives that will enhance formal

education and training in the biosciences for K-12 students and teachers.

***Tactic 1:*** Survey select K-12 and university bioscience programs for comparison to best assess UMBI's positioning in the marketplace.

***Tactic 2:*** Continue the revision and update of bioscience lab modules to meet current MSDE K-12 content and standards.

***Tactic 3:*** Expand UMBI's K-12 curricula to include laboratory modules in biosystems, medical and molecular/ cellular biotechnology.

***Tactic 4:*** Develop a comprehensive series of bioscience modules that address the needs of K-8 science curricula and AP high school science students.

***Tactic 5:*** Develop corresponding programs and scheduling that will create an "on-campus" and "off-campus" delivery system of bioscience programs throughout the State.

***Tactic 6:*** Promote and expand the loaner lab program to all Maryland public school systems.

***Tactic 7:*** Develop, promote and offer monthly professional development programs for science teachers to enhance their lab skills.

***Tactic 8:*** Design "Careers in the Biosciences" program and deliver it at middle and high school career days.

***Tactic 9:*** Submit proposals to governmental and private funding agencies for the funding of an after school "Biotech Academy" for select high school student populations (at risk, AP, etc.).

**Strategy 5:** Develop coordinated, results-oriented education and training programs for the bioscience workforce in both the public and private sectors.

***Tactic 1:*** Continue the development and delivery of workshops and tutorials for non-science professionals.

***Tactic 2:*** Develop and deliver a series of intellectual property and bioethics programs.

***Tactic 3:*** Further develop consortia that will assist UMBI's efforts to increase the education and training programs.

**Strategy 6:** Utilize evidence and evaluation-based approaches to enhance the effectiveness of all educational activities and initiatives.

***Tactic 1:*** Formalize relationships with UMB, UMBC, UMCP, TU and other comprehensive institutions of higher learning in terms of collaborating on new research grant proposal relating to teaching and learning in the biosciences.

***Tactic 2:*** Incorporate an evaluation component into all education and outreach initiatives.

***Tactic 3:*** Explore opportunities to participate in regional conferences on teaching and learning.

## Goal 4: Maximize economic impact of UMBI's programs

The introduction of new technology provides an increasingly important catalyst for economic growth. In recent years, the US economy and our society have been transformed by the impact of biotechnology, information technology and telecommunications. Discoveries in biotechnology have led to advances in medicine, biodefense, environmental clean-up, agriculture and manufacturing. UMBI is committed to leverage Maryland's investment in biotechnology, to train the next generation of the biotechnology workforce and to move science from the laboratory into industry. The following strategies build on UMBI's existing strengths in biotechnology and its success in expanding its technology portfolio.

**Strategy 1:** Create technology jobs and fuel innovation through sponsored research funding and research partnerships with industry, academic, federal laboratories, as well as state agencies and technology development organizations.

*Tactic 1:* Assist UMBI faculty to capitalize on non-traditional funding opportunities and funding sources.

*Tactic 2:* Foster interactions and teambuilding between UMBI Centers and other institutions in order to compete for large institutional grants.

*Tactic 3:* Maintain and adapt as necessary administrative processes to support UMBI research and assure compliance with diverse granting agency requirements.

*Tactic 4:* Facilitate meetings and follow-up between faculty members and representatives from companies with similar interests.

*Tactic 5:* Expand research efforts to Western, Eastern, and Southern Maryland to foster research at non-research campuses, take advantage of indigenous resources, and develop and support industrial biotechnology in those regions.

*Tactic 6:* Determine the economic impact in the State of Maryland resulting from UMBI sponsored research awards.

**Strategy 2:** Integrate research and development programs in biotechnology to maximize the potential commercial value through encouraging multidisciplinary collaborations focused on problems that meet future societal needs.

*Tactic 1:* Utilize both internal and external resources to identify commercially important problems that can be resolved utilizing biotechnology.

*Tactic 2:* Build research teams with expertise to address the commercially significant problems.

**Strategy 3:** Assess and invest in biotechnology programs with significant future potential commercial value through utilizing the UMBI Patent Review Board and expanding UMBI's investment in translational research.

*Tactic 1:* Utilize strength, weakness, opportunity, and threat (SWOT) analysis to assess technology opportunities.

*Tactic 2:* Encourage the faculty to develop partnerships or obtain private funding for advancing high value technology, including "proof of concept studies."

*Tactic 3:* Increase participation in state, local, and federal programs for funding translational research.

**Strategy 4:** Develop and protect technologies through selective patenting of discoveries with potential commercial value.

*Tactic 1:* Develop enhanced procedures that facilitate asset protection.

*Tactic 2:* Assess commercial value early by utilizing SWOT analysis and using demonstrated "proof of concept."

*Tactic 3:* Limit investment in foreign patents and divisional applications to the most commercially viable opportunities.

**Strategy 5:** Market UMBI technologies through licensing, establishing technology-specific virtual companies, forming a UMBI-biotechnology industry coalition, and facilitating growth of new biotechnology companies.

*Tactic 1:* Identify opportunities and venues to showcase UMBI technologies, core facilities and faculty expertise.

*Tactic 2:* Assess the market to identify customers for UMBI technologies.

*Tactic 3:* Bundle technologies when appropriate to provide technology platforms.

*Tactic 4:* Encourage sponsored research agreements to develop and subsequently commercialize UMBI technologies.

*Tactic 5:* Encourage participation in mentorship programs that bring together entrepreneurs and faculty to start new companies.

*Tactic 6:* Assist faculty in developing business and marketing plans.

**Strategy 6:** Train the next generation of biotechnology workforce through mentoring in specialized fields of research, development and manufacturing.

*Tactic 1:* Expand collaborations with degree-granting institutions to provide intensive, hands-on research training for graduate students with UMBI faculty.

*Tactic 2:* Design and deliver focused training for biotechnology workers based on the capabilities of UMBI's researchers and specialized core facilities such as those at UMBI Shady Grove (CARBII).

*Tactic 3:* Expand collaborations with degree-granting institutions to provide hands-on training for undergraduates through structured, credit-generating internship experiences.

*Tactic 4:* Expand the opportunities for visiting scientists from academia, government labs, and industry to acquire specialized skills by participating in UMBI research programs.

## Goal 5: Improve recognition of UMBI's accomplishments to advance UMBI's research programs

By enhancing internal and external communications, UMBI will expand strategic partnerships, improve the knowledge and skill base of biotechnology within the greater scientific and business communities, and maximize multidisciplinary collaborations to create effective scientific solutions to address societal problems and needs. To improve the recognition of UMBI, all members of the UMBI community must continue to communicate their accomplishments in a clear, concise and effective manner. The following strategies are designed to ensure that UMBI is recognized as a diverse research-driven institution unified in vision and mission.

**Strategy 1:** Consistently evaluate, re-define, and articulate the strengths, priorities and uniqueness of UMBI to inform the media, business, and education communities UMBI serves.

**"UMBI...a diverse research-driven institution unified in vision and mission."**

*Tactic 1:* Utilize a working group of unit-based communication liaisons to coordinate and facilitate all communications and marketing elements for UMBI.

*Tactic 2:* Utilize the findings of a UMBI SWOT analysis defining strengths (S) weaknesses (W) opportunities (O) and threats (T) to develop key promotional messages.

*Tactic 3:* Undergo a comparative analysis to benchmark UMBI against similar research institutions taking into consideration age of institutions, funding mechanisms, etc.

*Tactic 4:* Identify and assess UMBI-wide critical mass, strengths, and future collaborative and/or fundraising potential.

*Tactic 5:* Conduct a survey to measure internal and external audience perception of UMBI and its communications efforts.

**Strategy 2:** Utilize marketing and communications tools to perpetuate the identity of UMBI and its Centers, and become a preeminent biotechnology information resource for media, government, education and business entities in Maryland.

*Tactic 1:* Create a unifying tag line and promotional message for consistent use by UMBI and its Centers.

*Tactic 2:* Create a unifying graphic/visual presentation for all UMBI.

*Tactic 3:* Establish standard media relations protocols to facilitate increased media contacts.

*Tactic 4:* Utilize the UMBI website as a dynamic tool to reflect and support the mission of UMBI and its Centers, as put forth in the UMBI strategic plan.

*Tactic 5:* Develop and maintain a master list of industry stakeholders, other constituencies, former employees and students/trainees as a contact list for disseminating information and implementing fundraising efforts.

*Tactic 6:* Formally recognize and market the impact UMBI has on individuals who work or learn here.

**Strategy 3:** Expand the use of timely and effective internal and external communications vehicles to enable UMBI employees and interested parties to serve as informed ambassadors.

*Tactic 1:* Develop an institutional research data set for UMBI that is collected and archived regularly and consistently.

*Tactic 2:* Provide all staff and faculty with appropriate marketing and communications tools to enable them to promote an institutional affiliation and identity.

*Tactic 3:* Further enhance internal communication through formal and informal gatherings.

*Tactic 4:* Review and expand the use of external communication tools.

*Tactic 5:* Provide media training to appropriate staff and faculty.

**Strategy 4:** Facilitate interaction between UMBI faculty and staff and the constituencies they serve, so as to foster valuable new collaborations, exchanges, and strategic partnerships.

*Tactic 1:* Promote and publicize inter-Center scientific activities and exchanges.

*Tactic 2:* Expand interactions and dialog with USM staff and the Board of Regents.

*Tactic 3:* Create vehicles to communicate outcomes of meetings.

*Tactic 4:* Coordinate and expand outreach and marketing efforts to encourage collaborations.

**Strategy 5:** Utilize strategic public relations, marketing and communications tools to position UMBI to grow and adapt to meet new societal demands.
*Tactic 1:* Showcase UMBI's impact on Maryland and biotechnology using milestone-linked public relations and marketing campaigns.

*Tactic 2:* Create vehicles for recognizing faculty, staff and student achievements

and contributions to UMBI's success.

**Strategy 6:** Engage and strengthen the Board of Visitors to better serve UMBI's needs.

*Tactic 1:* Increase activities and contact between the Board of Visitors (BOV) and UMBI faculty members.

*Tactic 2:* Increase rotation of BOV membership to provide continuing guidance and expertise in areas that will help UMBI fulfill its mission.

# Appendix I: Strategic Plan Performance Metrics

| Goal | Metric (annual measure unless otherwise indicated) |
|---|---|
| 1, 2 | Multi-investigator/interdisciplinary grant awards (number of awards; total $) |
| 1, 2, 4 | UMBI-sponsored research events promoting interdisciplinary and inter-organization research (number) |
| 1, 2 | Core facility utilization ($ value of services provided/year, for UMBI and external clients) |
| 2, 4 | Partnerships with commercial, academic and governmental organizations (number active during the reporting year) |
| 2, 5 | Number of peer-reviewed publications (total; number of multiple PI pubs) |
| 2, 5 | External seminars/keynote addresses delivered (number) |
| 2, 5 | National and international honors and awards (number) |
| 3 | Number of dissertations supervised by UMBI faculty (Masters supervised, completed; PhD supervised, completed) |
| 3, 5 | Colloquia, tutorials, outreach programs on biotechnology for the public (number; attendees; satisfaction survey score) |
| 3, 4, 5 | Number of undergraduate internship placements at UMBI (number; satisfaction survey score) |
| 3 | Number of K-12 students served by UMBI education programs (total number/year) |
| 3 | Number of K-12 teachers served by UMBI training programs (total number/year) |
| 3, 4, 5 | Workforce Training program participants (number/year, excluding teachers; satisfaction survey score) |
| 1, 2, 4 | Extramural research funding (total $, number of awards, award $/eligible PI) |
| 1, 2, 4 | Invention Disclosures submitted to ORD (number/$1M research expenditures; annual) |
| 1, 2, 4 | Technology Asset Portfolio (number of IDF + patent applications + issued patents, total cumulative) |
| 1, 2, 4 | Number of active licensing agreements (total number) |
| 1, 2, 4 | Licensing revenue/$1M research expenditures |
| 1, 2, 4 | Number of start-up companies based on UMBI employee and/or technology in active operation (total, in MD; cumulative) |
| 5 | Number of media contacts concerning UMBI programs |
| 5 | External recognition and perception of UMBI as measured by survey instrument (score on a scale) |
| 5 | Usage of UMBI website (hits/day) |

# Appendix II

Thank you to all of the members of the UMBI community that served on one or more workgroups tasked with developing this Strategic Plan.

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Harriet Danko
Colleen Dove
Dean Drake
Ed Eisenstein
Adam Frederick
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Zvi Kelman
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Claude Nash
David Newman
Gwendolyn Newman
Kay Noel
Don Nuss
Greg Payne
Al Place
Robert Powell
Jerry Regier
Dan Reznikov
Frank Robb
Greg Silsbee
Harold Smith
Rick Tysor
Vikram Vakharia
Dave Wilkins
Pamela Wright
Yoni Zohar


**Executive Offices**
9600 Gudelsky Drive
Rockville, MD 20850
Telephone: 301-738-6250

**Central Administration**
701 East Pratt Street, Suite 200
Baltimore, MD 21202
Telephone: 410-385-6300
Fax: 410-385-6312


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